

78. (Twice amended) A via, comprising:

a first layer of an electrically conductive, [nitride-free titanium alloy] titanium zinc alloy within a contact opening in an insulating layer, wherein the first layer is produced using a method including:

forming a seed layer supported by a substrate by combining a first precursor with a first reducing agent;

forming the titanium layer supported by the substrate by combining a titanium-containing precursor with the seed layer; and

filling the remaining space of the contact opening with a metal selected from the group consisting of tungsten and aluminum.

81. (Amended) The via of claim 78, further including a second layer of titanium silicide coupled to the titanium zinc alloy.

REMARKS

Applicant has carefully reviewed and considered the Office Action mailed on September 11, 2002, and the references cited therewith.

Claims 51, 53, 55, 56, 60, 66, 73, 75, 78, and 81 are amended, claims 74, 79, and 80 are canceled without prejudice or disclaimer, and no claims are added; as a result, claims 51-56, 60-73, 75-78, and 81-85 are now pending in this application.

§102 Rejection of the Claims

Claims 51, 53-56, 60, 62-66, 68-73, 75-79, and 81-85 were rejected under 35 USC § 102(a) as being anticipated by Honeycutt et al. (U.S. 5,644,166).

The rejections stated that Honeycutt discloses “an electrically conductive nitride-free titanium alloy layer formed overlying walls an exposed base layer of a contact hole.” Honeycutt appears to show a titanium germanosilicide region 50 formed at the bottom of a contact opening. Honeycutt appears to show a titanium germanide layer 52 formed on the sides of the contact opening. However, Honeycutt does not show a single electrically conductive, titanium alloy

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layer formed overlying walls and an exposed base layer of a contact hole.

In contrast, Applicant's amended claims 51, 53, 55, 56, 60, and 66 include a single electrically conductive, titanium alloy layer formed overlying walls and an exposed base layer of a contact hole.

Because the Honeycutt reference does not show every element of Applicant's independent claims, a 35 USC § 102(a) rejection is not supported. Reconsideration and withdrawal of the rejection is respectfully requested with respect to Applicant's independent claims 51, 53, 55, 56, 60, 66, 73, and 78. Additionally, reconsideration and withdrawal of the rejection is respectfully requested with respect to the remaining claims that depend therefrom as depending on allowable base claims.

Allowable Subject Matter

Claims 52, 61, 67, 74, and 80 were objected to as being dependent upon a rejected base claim, but were indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicant acknowledges and thanks the examiner for the indication of allowability of claims 52, 61, 67, 74, and 80 if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicant submits that amendments made to independent claims 73 and 78 incorporate the limitations of dependent claims 74 and 80 respectively as suggested. Indication of allowance of claims 73 and 78 as well as claims that depend therefrom is respectfully requested.

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Conclusion

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney (612 373-6944) to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Box RCE, Commissioner of Patents, Washington, D.C. 20231, on this 12th day of November, 2002.

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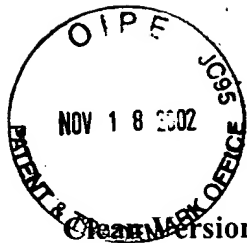
Amy Moriarty

Signature



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Docket No. 303.676US5
WD #394631



Micron Ref. No. 92-0560.06

Clear Version of Pending Claims

CHEMICAL VAPOR DEPOSITION OF TITANIUM

Applicant: Gurtej Singh Sandhu et al.

Serial No.: 09/941,125

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Claims 51-56, 60-73, 75-78, and 81-85, as of November 12, 2002 (date of response to final office action filed w/ RCE).

51. (Twice amended) A via, comprising:
a single electrically conductive, titanium alloy layer formed overlying walls and an exposed base layer of a contact hole; and
a fill coupled to the titanium alloy layer, wherein the fill comprises a metal selected from the group consisting of tungsten and aluminum.

52. The via of claim 51, wherein the titanium alloy layer comprises titanium and zinc.

53. (Twice amended) A via, comprising:
a single electrically conductive, titanium alloy layer formed overlying walls and an exposed base layer of a contact hole, wherein the titanium alloy layer comprises titanium and an element selected from the group consisting of zinc, cadmium, mercury, aluminum, gallium, indium, tin, silicon, germanium, lead, arsenic and antimony; and
a fill coupled to the titanium alloy layer, wherein the fill comprises a metal selected from the group consisting of tungsten and aluminum.

54. The via of claim 51, further comprising a titanium nitride layer interposed between the titanium alloy layer and the fill.

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55. (Twice amended) A via, comprising:
a single electrically conductive, titanium alloy layer formed overlying walls and an exposed base layer of a contact hole;
a fill comprising a metal selected from the group consisting of tungsten and aluminum;
and
a titanium nitride layer interposed between the titanium alloy layer and the fill.

56. (Twice amended) A via, comprising:
a single electrically conductive, titanium alloy layer formed overlying walls and an exposed base layer of a contact hole, wherein the titanium alloy layer comprises titanium and an element selected from the group consisting of zinc, cadmium, mercury, aluminum, gallium, indium, tin, silicon, germanium, lead, arsenic and antimony;
a fill comprising a metal selected from the group consisting of tungsten and aluminum;
and
a titanium nitride layer interposed between the titanium alloy layer and the fill.

60. (Twice amended) A via, comprising:
a first layer of a single electrically conductive, titanium alloy within a contact opening in an insulating layer, wherein the titanium alloy comprises titanium and an element selected from the group consisting of zinc, cadmium, mercury, aluminum, gallium, indium, tin, silicon, germanium, lead, arsenic and antimony;
a second layer of titanium silicide coupled to the first layer; and
a fill coupled to the titanium alloy layer, wherein the fill comprises a metal selected from the group consisting of tungsten and aluminum.

61. The via of claim 60, wherein the first layer includes a titanium zinc alloy.

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62. The via of claim 60, further including a titanium nitride layer interposed between the titanium alloy layer and the fill.
63. The via of claim 60, wherein the first layer is coupled to a sidewall of the contact opening.
64. The via of claim 60, wherein the second layer is coupled to an exposed semiconductor surface.
65. The via of claim 60, wherein the contact opening includes a high aspect ratio contact opening.
66. (Twice amended) A via, comprising:
a first layer of a single electrically conductive, titanium alloy within a high aspect ratio contact opening in an insulating layer, wherein the titanium alloy comprises titanium and an element selected from the group consisting of zinc, cadmium, mercury, aluminum, gallium, indium, tin, silicon, germanium, lead, arsenic and antimony;
a second layer of titanium silicide coupled to the first layer; and
a fill coupled to the titanium alloy layer, wherein the fill comprises a metal selected from the group consisting of tungsten and aluminum.

67. The via of claim 66, wherein the first layer includes a titanium zinc alloy.

68. The via of claim 66, further including a titanium nitride layer interposed between the titanium alloy layer and the fill.

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69. The via of claim 66, wherein the insulating layer includes borophosphous silicate glass (BPSG).

70. The via of claim 66, wherein the insulating layer includes silicon dioxide (SiO₂).

71. The via of claim 66, wherein the first layer is coupled to a sidewall of the high aspect ratio contact opening.

72. The via of claim 66, wherein the second layer is coupled to an exposed semiconductor surface.

20/3. (Twice amended) A via, comprising:
a first layer of an electrically conductive, titanium zinc alloy on a sidewall of a high aspect ratio contact opening in an insulating layer;
a second layer of titanium silicide formed overlying an exposed semiconductor base layer of the contact hole;
a fill coupled to the titanium zinc alloy layer, wherein the fill comprises a metal selected from the group consisting of tungsten and aluminum.

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C7 21/20 75. (Amended) The via of claim 73, further including a titanium nitride layer interposed between the titanium zinc alloy layer and the fill.

76. The via of claim 73, wherein the insulating layer includes borophosphous silicate glass (BPSG).

77. The via of claim 73, wherein the insulating layer includes silicon dioxide (SiO₂).

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24/78. (Twice amended) A via, comprising:
a first layer of an electrically conductive, titanium zinc alloy within a contact opening in an insulating layer, wherein the first layer is produced using a method including:
forming a seed layer supported by a substrate by combining a first precursor with a first reducing agent;
forming the titanium layer supported by the substrate by combining a titanium-containing precursor with the seed layer; and
filling the remaining space of the contact opening with a metal selected from the group consisting of tungsten and aluminum.

09/25/81. (Amended) The via of claim 78, further including a second layer of titanium silicide coupled to the titanium zinc alloy.

- 82. The via of claim 78, further including a titanium nitride layer interposed between the first layer and the fill.
- 83. The via of claim 81, further including a titanium nitride layer interposed between the second layer and the fill.
- 84. The via of claim 78, wherein the first layer is coupled to a sidewall of the contact opening.
- 85. The via of claim 78, wherein the first layer is coupled to a high aspect ratio contact opening.

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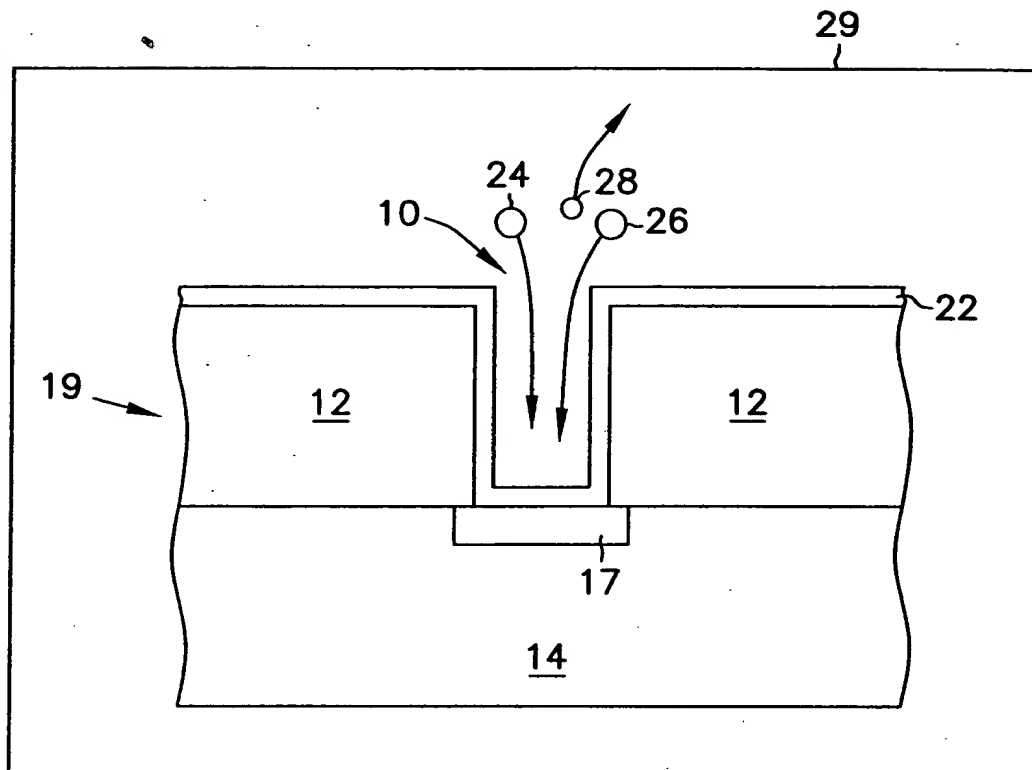


FIGURE 2

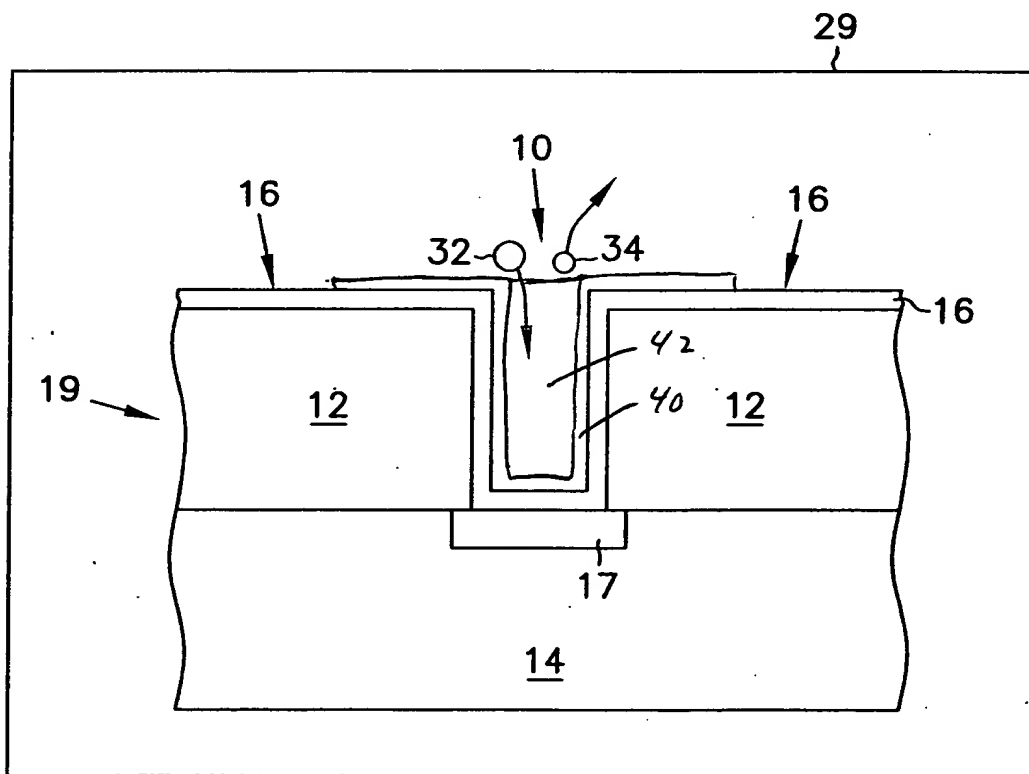


FIGURE 3A